The Nutritious Pond Project

Newsletter #4, December 2016

Recent Activities

Field trials : testing the Nutritious Pond concept in smallholder ponds

Fundamental research on Omega-3 Transfer and algae: bacteria balance

The Nutritious Pond Porject at the International Fisheries Symposium 2016, Phu Quoc, Vietnam

Field trials

From June to September 2016:

- 2 extensive ponds were stocked @ 9 PL/m^2
- 3 rice-shrimp ponds were stocked @ 30 PL/m^2

The farmers applied both conventional pelleted feed provided by Skretting and carbohydrate powder composed of rice bran and cassava. In those trials the amount of pelleted feed was reduce to 75% of the recommended amount. Post larvae were provided by Viet Uc, and Skretting supported partially feed and carbohydrate.

In addition, 4 ponds (2 extensives and 2 intensives) stocking PL from the same hatchery and applying commercial feed as recommended by the supplier, were used as control ponds.

Rice-Shrimp Ponds

- The productivity was recorded between **2.3 to 3 tons per hectare in nutritious ponds**, reaching similar range of productivity that in conventional system used before the trials.
- Compare to control ponds and neighbouring ponds, the growth period was equal (64 days) or longer with delayed symptoms of diseases or no disease at all after 80 days of culture. The farmers decided to harvest early when observing lack of appetite or slow growth, which could be a sign that the shrimp are becoming sick, with the risk of disease related mortality.

- Economically, the Nutritious Pond system was beneficial with lower operational cost due to less direct expenditure for feed and carbohydrate (8 to 10% reduction).
- The use of carbohydrate enhanced the pond food web, while farmers used less pro-biotics and minerals during culture, reducing the farming costs with about 500 USD/ha, when we compared with farmers applying the control treatment.

Preliminary results of trial in rice-shrimp ponds (stocking density: 30 PL/m²; P. vannamei)

	Trial 01	Trial 01	Trial 01	Control 01	Control 01
Growth period (days)	71	87	64	64	41
Disease/Reason to harvest	No/Slow growth	No/Normal growth	No/Stop eating	No/Stop eating	EMS
Yield (kg/ha)	3,045	3,000	2,198	1,887	325
FCR	0.38	0.64	0.44	1.4	3.07
Size (pcs/kg)	112	70	86	170	180
Cost (USD$/ha)	4,665	6,032	3,644	7,520	3,420
Net Income (USD$/ha)	5,716	7,160	5,246	Negative	Negative

"Water colour is stable, green for longer time while usually turning brown around day 40. The pond looks better and water quality is better than capplying the conventional feeding schedule"

“The growth of the shrimp is not fast enough, the shrimp are small after 84 days : only 70 pieces per kg while it should be 60 pcs/kg like with conventional feeding.”

According to farmers, the main benefit of using this new feeding system is the **reduction of the cost** because less feed and probiotics are used.

Daily application of carbohydrate by farmers was not challenging and did not required significant additional workload.

Preparing carbohydrate mixed with water duirng 24h

The natural food produce by the pond seems to be more important and available for the shrimp compare to conventional feeding system and the animal looked healthy. Farmers noticed less organic matter accumulated at the pond bottom than in conventional ponds.

The new feeding system needs to be further improved and fine tuned. Farmers thinks that the growth rate was not adequate in all the tested ponds with sometimes slow growth and large differences in yield and shrimp size at harvest (70 to 112 pcs/kg) across trial ponds. The size of the animals at harvest was highly variable, which might indicate that sub-dominant individuals did not get enough food. The overall food conversion ratio (FCR) was however very low, which means the feeding efficiency was excellent.

Spreading Carbohydrate

Extensive ponds

The stocking density was 9 PL/m^2 and farmers used carbohydrate and pelleted feed as opposed to their conventional practice without any external feeding. Farmers practiced a partial harvest and the growth period was between 48 and 79 days. This short growth period was the results of adverse climatic condition with heavy rain affecting the region 40 days after stocking.

- High mortality was observed after a heavy rain at 48 days after stocking. This pond yielded a total of 278 kg/ha. In the second trail pond the growth period was longer (79 days for the last harvest) with a final yield of 382 kg/ha.
- The control ponds where heavily affected by EMS after 32 and 48 days, with a maximum yield of 120 kg/ha.
- Economic results were positive in one of the trail ponds, with over 382 kg/ha and a net income over 1,800 USD$/ha.

As expected, farmers involved in the trials noticed that the growth rate of the shrimp was higher than in conventional method without feeding. Farmers noticed a higher survival rate and, as in the intensive ponds, a better water quality, with a green pond colour instead of the usual brown colour.

What did we learn and what needs to be improved

The preliminary analysis of the trials shows that in all the 3 rice-shrimp ponds the use of carbohydrate combined with lower load of manufactured pellets does not reduce the productivity of the ponds while reducing operational costs. Ponds look more resilient, with a better ecological status that can increase the duration of the culture period in a region affected by diseases.

In the extensive ponds, use of commercial pellets combined with carbohydrate increase the operational cost, but can provide higher yield and provide positive economic return when growth period is long enough.

The next innovation platfrom meeting in February 2017, will be the opportunity to discuss the results and the improvement of the technology. For example:

- The use of carbohydrate might requires additional aeration to facilitate its degradation by micro-organism
- Feeding schedule and feed amount should be fine tuned, making sure the number of animals starved remain small
- Other source of carbohydrate can be tested
- Storage of carbohydrate needs to be improved

Additional pond trails will be conducted in 2017 in rice-shrimp and extensive ponds, to fine tune the Nutritious Pond system.

In addition, trails in super intensive systems (200 and 400 PL/m^2) will start in Viet Uc facilities in Bac Lieu on December1st 2016.

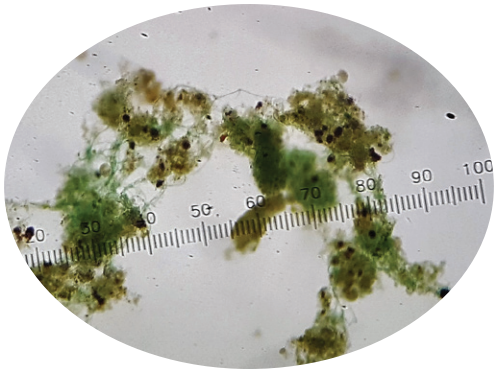
Fundamental Research

Tran Huu Tinh, Vietnam

In the past weeks, Tinh looked at the effects of carbohydrate addition on microbial activity and algae production, water quality and performance of shrimp culture. The experimental design included 3 different feed loads and 3 different C/N ratio tested in a controlled environments (tanks) on *P. vannamei* stocked at 120 PL/m^3.

Preliminary results show that the C/N ratio and feed load influence biomass, final average weigh of the animal, survival rate and FCR. For example, Tinh observed that reducing the feed load 40% while doubling the C/N ratio (up to 16) did not significantly reduce the total biomass harvested.

- In particular, the treatment with a feed load reduction of 20% combined with carbohydrate addition compared to standard feeding practices yielded similar final weight than than in control ponds (100% feed load and C/N ratio of 8).
- Also, increasing C/N, while reducing the feed load with 40% reduces the FCR, thus increasing the efficiency of the system.



These promising results are presently further worked out, analyzing linkages between feed type and load and water quality and C/N ratio.

Devi Hermsen

Results from the first experiment showed that fishmeal and fish oil, carriers of ω3 poly unsaturated fatty acids (PUFA) in formulated pelleted feeds, can be replaced by vegetal compounds, poor in ω3-PUFAs, when the natural primary productivity of the pond is stimulated. Grow and survival rate is not affected by removing fish oil and fish meal from pelleted feed, when fully replaced by vegetal compound.

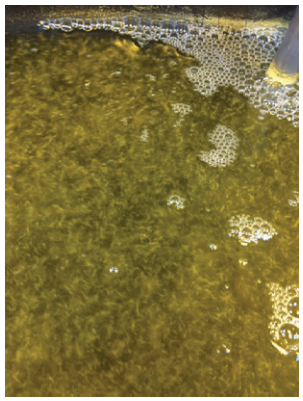
The second experiment looked at the effect of C:N:P input on natural ω3 fatty acid production and transfer, and shrimp performance, with a special focus on P input and its distribution through the pond's food web.

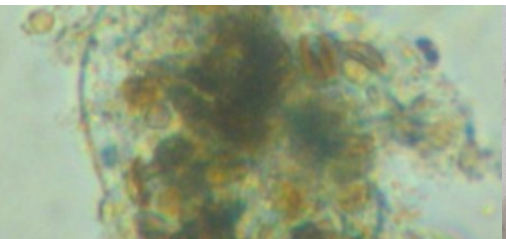
To do so the *experimental design* was a follows:

- Devi use 6 treatments differing in feeding level using the same low omega-3 shrimp diet as in the first experiment.
- Every treatment received 10% less feed than the previous treatment and the lack of C and N input due to feed reduction was compensated by adding C and N inorganic fertilisers. It means that each treatment received the same amount of C and N, the difference was in the form of the input.
- Because there was no compensation for the loss of P, treatments differed in P input. Therefore, the experiment looked at the effect of P reduction on the food web.

*Preliminary result*s, shows that:

- There was an optimum treatment: the treatments receiving 60% and 70% of the normal feed load had a higher fat content of the shrimp, higher survival rate and strongly improve FCR (lowered to 0.68) compared to the treatment receiving 100% and 90% (with FCR of 1.03 and 1.67, respectively).





Results also shows that the less P is added to the system, the more P the shrimp assimilate, with a P retention of 30% in the treatment with the lowest P input (usually the P retention for shrimp is about 15% to 20%).

Further explorations of the results need to investigate if :

- Fish meal and fish oil can be fully replaced during the first two months of culture;
- Feed input can be reduced by 40% as long as there is additional fertilizer for C and N while additional P fertiliser is not needed.

Once analysed the results will help to design recommendations for specific C, N, P inputs and mode of use for formulated feed (or additives) to increased natural food quality and intake.

International Fisheries Symposium

The Nutritious Pond team attended the International Fisheries Symposium in Phu Quoc Island (in Vietnam) from 31st October to November 3rd 2016. It was the opportunity to present preliminary results and share our experience with international experts.

Kabir presented the results of his research in Bangladesh :

"Understanding the role of feed in shrimp ponds and matching natural and supplemental feeds for sustainable shrimp production"

Devi presented a poster: *"In situ production of omega-3 polyunsaturated fatty acids (pufa) in shrimp ponds."*

Olivier poster was about the project approach: *"Innovation platforms in aquaculture: the case of the nutritious pond system project."*

PASMI project another supported by NWO WOTRO that use similar systemic approach to innovation presented early results from the Rapid Appraisal of Aquaculture Innovation system conducted in Indonesia :

" Challenges and alternative solution for small scale fish farmers in mangrove restoration area: a stakeholder's"





Next issue April 2017

- *Project progress and activities*
- *Design of new trials*
- *Research outputs*
- *Results of trials in super intensive systems*

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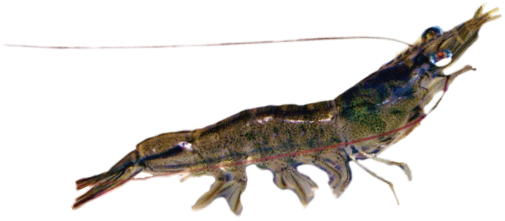

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Credit Icons
Shrimp by Iconic from the Noun Project -
Research by Gregor Črešnar from the Noun Project
Conference by Cedric Cummings from the Noun Project